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The Citrus Industry

This Month

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Citrus Exposition At Winter Haven, Feb. 16-21

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Citrus Insect Control For January, 1953 . . .

R. M. PRATT AND W. L. TMOMPSON*
CITRUS EXPERIMENT STATION,
LAKE ALFRED, FLORIDA

The average purple scale infestation has been increasing steadily since the end of September and at the time this was written the average was higher than that reached in July. Comparatively few groves have heavy infestations but moderate infestations are common and numerous reports of fruit drop caused by purple scale at the stem end of the fruit have been received. A peak of hatching was passed at the end of November and some reduction in activity can be expected to continue into January.

Red scale activity has been low during the fall months and no particular change in the situation can be foreseen at this time.

Rust mite activity has been at a high level since August and the level is particularly high on leaves at this time. While it is not clear what the trend during January will be, it is to be expected that the level will remain high enough to warrant general application of dormant sprays.

Purple mite activity has been increasing sharply during November and December and the indications are that this trend will continue into January. Leaf drop caused by purple mite injury is commonly reported.

Six-spotted mites are being found in some groves and there is the possibility of their becoming a general problem in the post-bloom period when control is difficult. The dormant application of a miticide recommended for purple mite control will reduce this danger. Mealybugs are being found on mature and late bloom fruit in a number of groves.

SPRAY PROGRAM

The first of the year is an excellent time to examine the groves and grade them according to the severity of scale infestations as well as to inspect the lower surfaces of the leaves for six-spotted mites and the trunks and limbs for mealybugs that may be hibernating under bark and in various depressions. A good idea of the type of dormant and post-bloom program needed can be obtained by checking the groves at this time.

*Written December 23, 1952. Reports of surveys by Harold Holtsberg, Cocoa; J. W. Davis, Tavares; K. G. Townsend, Tampa; J. B. Weeks, Avon Park; and T. B. Hallam, Lake Alfred.

The important insects and mites to keep in mind while checking the trees are purple scale on leaves, wood and fruit; red scale on fruit and leaves; purple mites on leaves and green twigs; six-spotted mites on the under surfaces of the mature leaves and on lemon sprouts; and rust mites on leaves, twigs and fruit.

In some groves heavy infestations of purple scale or red scale should be controlled before the spring growth starts and many groves should be sprayed with an effective miticide to control purple mites and insure good six-spotted mite control. Six-spotted mite infestations seldom develop in the spring in groves that have received a dormant application of an effective miticide for purple mite control. During January or before the growth starts a dormant copper application should be made on groves where scab is a problem in Temple groves and in grapefruit groves in the coastal areas. Nutritional sprays containing borax and compounds of zinc, manganese and molybdenum are often included in the dormant spray. Any two or more of these materials may be combined in one spray with few exceptions. Parathion and DN compounds can be combined with the nutritional elements as long as the spray solutions do not have a pH above 7.5 but Ovotran and Orthotran can be used in solution having a higher pH.

Scale Control: In groves where heavy infestations of either red or purple scale exist an application of 1 2/3 pounds of parathion should be used. Sulfur and other materials needed for insect, mite or nutritional purposes can be added if desired. If oil is to be used the application should be made in late January or in February if the spring growth has not started. If it does not take more than a few days to spray the grove it is better to delay the oil spray until there is pinpoint growth than to risk spraying the grove with oil and have freezing weather following the application. The neutral coppers can be combined with oil emulsions but care should be taken to prevent flocculation. An oil emulsion spray should not be sprayed on Valencia trees if the fruit crop has not fully colored. Whether oil or parathion is used for scale control, a second application should be made sometime in the summer.

Mealybug Control: Parathion is very effective in controlling mealybugs. In groves that had been sprayed in either January or February with 1 2/3 pounds of parathion per 100 gallons the mealybug control was more satisfactory than with post-bloom sprays. However, a thorough coverage of limbs and tree trunks is necessary for satisfactory control.

Mite Control: Purple mite infestations should be kept at a low level during January and February to prevent leaf drop. Effective miticides include the DN compounds, Ovotran and Orthotran. The DN compounds should not be used in alkaline solutions and if they are used the application should be made before the spring flush of growth starts. The longest periods of control are obtained with any of the miticides when the applications are made on light infestations.

A dormant application of any of the miticides used for purple mite control is effective for controlling six-spotted mites. However, for effective control a thorough coverage of the lower surfaces of the leaves is necessary.

Rust mite control is necessary to prevent russeting of the fruit, leaf drop and "greasy spot." By reducing the infestation to a low level in January or February there will not be so much chance of early rust mite injury on young fruit in the spring if the post-bloom spray is delayed for some reason. The form of sulfur to be used depends upon the other materials to be used in the spray. Wettable sulfur can be used with any of the materials except oil emulsion. For rust mite control alone, one gallon of lime-sulfur plus 5 pounds of wettable sulfur is effective. Ovotran or Orthotran can be used with lime-sulfur for purple mite control but the DN compounds can not.

Where possible the dormant spray should be applied after the fruit has been picked. During this time of the year the trees have fewer leaves which makes it possible to get a thorough coverage with the minimum gallonage per tree.

For detailed information on combination sprays refer to the 1952 or

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Evidence of Tristeza, or Quick Decline, Virus In Florida

Theodore J. Grant[1,2]
At Meeting
Florida State Horticultural Society

Information given in this paper concerns the finding of a strain of the tristeza, or quick decline, virus in Florida, the proof of its presence, and a discussion of some important aspects.

Detecting the Presence of Tristeza Virus in Florida

The usual method of recognizing tristeza has been by comparison of the behavior of sweet orange scion varieties on sour orange rootstock with adjacent trees or adjoining blocks of trees of the same variety on Rough lemon or sweet orange rootstock. Trees on sour orange stocks show decline, whereas on the other two stocks they are apparently healthy. This difference, noted first in South Africa, was an initial means of recognition of the disease in South America and in California. This, however, was not the case in Florida, where the methods employed to detect the disease are the result of experience and five years of intensive cooperative research work of the U. S. Department of Agriculture and the Institute Agronomico at Campinas, Brazil.

When the writer came to Florida in May 1951, seed of West Indian limes of the Key, Beledy, and Kirk varieties were obtained and planted. Not only was the value of these varieties as test plants for detecting the tristeza virus recognized in Brazil (9), but also vein-clearing and stem-pitting symptoms had been reported on West Indian limes inoculated with the tristeza, or quick decline, virus in South Africa (12) and in California (16). Although in May 1951 no one recognized tristeza in Florida, it seemed desirable to inoculate the lime plants as soon as possible with living branch material from trees having common diseases for which the casual agent had never been satisfactorily determined. Some of the common diseases in Florida that can be included in this category are blight, spreading decline, xyloporosis, cachexia (Orlando tangelo disease), and lime bark disease. The first objective was to determine what symptoms, if any, would occur on the inoculated lime plants. These were expected to have considerable value, because these diseases are widespread and any symptoms that developed could be compared with the known tristeza symptoms on inoculated West Indian limes.

The first series of Beledy lime plants was inoculated between September and November 1951. A bottle-graft method of inoculation similar to that described by Bennett and Costa (1) was employed. Living twigs were taken from diseased trees, the leaf surface was reduced to one or two half leaves, and then the twigs were approach-grafted into the stems of the healthy lime test plants. The cut ends of the twigs were immersed in vials of water until the union was established.

A variety of symptoms developed on the test plants and in some cases the test plants died. This was particularly true of those bottle-grafted with material from diseased Persian limes. In other cases the test plants showed some yellowing of leaves and leaf drop. Some attempts were made to transmit these disease symptoms from the test plants to the other seedlings and to graft with more material from the diseased field trees. None of the symptoms found up

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2. Acknowledgement is made of the kind and effective help of J. F. L. Childs, who oriented the writer concerning the various citrus diseases in Florida and cooperated in many other ways. Also appreciation is expressed for the helpful suggestion of J. R. Winston, who gave freely of his knowledge of the history and development of citrus in Florida and helped to acquaint the writer with grove owners who cooperated in the investigational work.

to February 20, 1952 resembled in any way the definitely known reaction of West Indian lime plants to tristeza virus. However, on that date the first vein-clearing symptoms were found on three leaves of one plant. By February 29 vein-clearing symptoms were found on a total of four of ten plants grafted with material collected from two widely separated areas—Ocoee and Avon Park.

On March 5 a window of bark was removed from each of the infected plants and stem pits were observed. Following this initial indication of the presence of tristeza virus in the Ocoee and Avon Park areas, work with other diseases was curtailed and all effort was devoted to obtaining further proof of the presence of tristeza.

A general survey of some of the groves at Ocoee and Winter Garden revealed a number of sweet orange trees on sour orange rootstock in a state of decline. Bark samples for anatomical study were obtained from the point of union of the sweet orange top and the sour orange rootstock. Twigs from these trees were collected for inoculation of West Indian lime plants. Bark samples were placed in a fixing solution, transferred to alcohol, and shipped to Henry Schneider, who has been studying similar material in California for several years (147 (15).

Results of Anatomical Study of Bark Samples and Inoculation of Test Plants

The preliminary results of inoculation of West Indian limes and of anatomical study of bark samples have been summarized (11). Schneider classed 11 of 26 bark samples studied as having positive symptoms similar to those of quick decline, 8 samples as possible quick decline, and 7 as negative, having no symptoms resembling quick decline.

Bottle-graft inoculations with twigs from 13 declining field trees resulted in the production of definite vein-clearing on the leaves of West Indian lime plants. Lime plants bottle-grafted with twigs from four other field trees were observed to produce faint vein-clearing symptoms. Examination of five of the earliest inoculated lime plants that showed definite vein-clearing revealed the presence of pits on the stem beneath the bark. In addition, the transmission of the causal virus from artifically infected lime plants to healthy ones by means of bottle-grafts was successful, resulting in the production of vein-clearing symptoms on the leaves of the inoculated plants.

In September examination of the lime plant material held under screenhouse conditions not only confirmed the earlier results but also showed that lime plants from 26 field tree sources showed both vein-clearing and stem-pitting symptoms. Study of additional bark samples sent to Henry Schneider by J. F. L. Childs and of Key lime plants bottle-grafted with twigs from suspected trees revealed that the tristeza virus was also present in the Windermere, Umatilla, and Plymouth areas.

Discussion

There is no doubt as to the presence of a strain of the tristeza, or quick decline, virus in Florida. It is of special interest that the observed reactions of the infected Key and Beledy lime plants in the screenhouse suggest that the strain of the virus present is intermediate or mild. At least the strain of the virus studied in Florida is not as severe as was the common strain studied in Brazil (8). The infected lime plants in Florida partially recover and some growth continues. Likewise, the infected trees in the field, although showing a range in degree of decline symptoms, have not died rapidly. One grove owner states that trees with a similar appearance have been noted in his grove for ten years, but that such trees are more prevalent now than previously. Such information obtained from grove owners, plus the fact that affected trees are known in widely separated areas, strongly suggests that this virus has been in Florida for 6 to 10 years or even more. It is obviously important to obtain further information as to its occurrence in other parts of Florida.

One may wonder how it was possible for quick decline, or tristeza, to be in Florida for a number of years and possibly to be widespread without detection. Decline of individual or scattered trees has been considered as being due to other causes. Our knowledge of the tristeza disease has increased greatly during the past 5 years (2, 3, 4, 7, 10) and the use of the West Indian limes to test for detection of the tristeza virus had not been employed previously in Florida.

On the basis of the observations made here and in California, the writer believes that the situation in Florida parallels more closely that in California than that in Brazil. In Brazil (3) and also in Argentina, as noted by DuCharme and Knorr (6), there was a comparatively efficient aphid insect vector that could spread the virus from tree to tree effectively. Most groves were planted on the non-tolerant sour orange rootstock, and evidence of rapid spread was apparent. The virus strain common in Brazil was also more severe than that so far encountered in Florida. In Los Angeles County, California, where most of the trees are on sour orange rootstock, infected trees, according to orchard surveys by the State and County agricultural departments, increased from 146 trees in 1940 to approximately 200,000 trees by 1949. Quick decline certainly cannot be considered an unimportant disease in California, but it has not wiped out the plantings with the rapidity experienced in South America. Probably the important factor in the slower spread in California is the relatively inefficient aphid vector found there (5). Fortunately, the more effective vector, **Aphis citricidus** (Kirk), found in South America and South Africa, is not known to be present in the United States.

That a strain of the tristeza, or quick decline, virus is present in California, Louisiana, and Florida is certain. Theer is a definite need for further investigation of the tristeza virus in Florida, the insect vectors, and the reactions of infected citrus varieties under field conditions.

The basis for judging that the virus strain found to date in Florida is comparatively mild is the behavior of the inoculated lime plants. The basis for presuming that we have an inefficient insect vector is the fact that **Aphis citrididus**, an efficient vector, is not known to exist in the United States and that work in California with various insects has resulted in but few successful transmissions in the many trials made. To date the visibly diseased trees in Florida have not exceeded 15 to 20 percent in any one block and in many of the areas examined there are at present only a small number of visibly diseased trees. This situation would seem to indicate a mild virus strain and a relatively ineffective vector.

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The fact that only a mild strain of the virus has been found does not mean that a more severe strain may not be found later. Also it does not mean that the strain is mild enough to allow infected sweet orange trees on sour orange rootstock to survive and produce indefinitely. In fact, it is obvious that under field conditions the visibly diseased trees are in poor condition and some of the individuals first observed as diseased in June are now dead.

If a mild strain and an inefficient insect vector are presumed, then a planting of sweet orange trees on sour orange rootstock may decline slowly enough so that the grove owner may find it worth while to replant individual affected trees with sweet orange on a tolerant rootstock. This is certainly one possibility that needs investigation. There may also be some trees where rooting of the scion top by mounding of the earth around the base or inarching with a tolerant seedling might be feasible. These possibilities also should be given attention in experimental work. With these last two procedures it should be kept in mind that the tree remaining, although it would recover from symptom expression of tristeza, would nevertheless remain as a reservoir of the virus which could be transmitted to other trees by an insect vector.

Perhaps the most important aspect of the occurrence of a mild strain of tristeza in Florida is its possible effects on grapefruit. Tests in Campinas, Brazil, showed that grapefruit inoculated with the severe form of the tristeza virus was unsatisfactory as a rootstock for sweet orange; grapefruit also showed disease symptoms when inoculated as a seedling and was affected even when the inoculated top was grown on a tolerant rootstock (9). Experience in South Africa (13) shows that the stem-pitting disease caused gradual deterioration of grapefruit even when grown on Rough lemon rootstock. The identity of this stem-pitting condition on grapefruit with tristeza disease has been pointed out in previous publications (4, 9). In areas where the tristeza disease is prevalent the continued economic production of grapefruit requires the use of tolerant rootstocks. In such areas the presence of a mild, rather than a severe strain of the virus would be expected to cause less damage. The reaction of grapefruit to the tristeza strain present in Florida has yet to be determined. It can be stated, however, that pits typical of tristeza have been found under the bark of some grapefruit trees in Florida. Twigs from the crown of these trees have been bottle-grafted to Key lime plants to determine the presence of the virus but results are not yet available. It should be evident from the foregoing discussion that there are many things still to be done.

Steps have already been taken to determine the distribution of this disease in the State. Early in June, as soon as the presence of the quick decline, or tristeza, virus in Florida was substantiated by the reaction of the test plants in the screenhouse and the diseased trees in the field were definitely proved to be infected with tristeza virus, the Florida state officials were notified. The Commissioner of the State Plant Board, together with officials of the Lake Alfred station, came to Orlando and went over all the findings. Subsequently, the State Plant Board sent its grove inspectors to Orlando for training in recognition of the disease. On July 10 the State Plant Board called a meeting at Lake Alfred of some of the leading representatives of the citrus industry, together with representatives of the State and Federal government. The detailed information available at that time was presented. A brief notice was prepared for the press, and a joint plan of action was discussed. Grove inspectors, after locating a suspect tree, take bark samples that are sent to Robert Pratt at Lake Alfred. When the bark samples are identified as positively or possibly affected with tristeza, on the basis of symptoms in the bark, then budwood is obtained and a test for transmission to lime plants is carried on in the screenhouse in Orlando.

It seems certain that spread of the tristeza virus in Florida is going to continue. In order to deal with it information must be obtained, for example, on present tristeza virus distribution in the State. The reaction of different citrus varieties to the virus strain or strains and a knowledge of the insect carriers of the virus must also be obtained. Even the preliminary studies made to date indicate that in any intensive study of the tristeza disease under field conditions there will be complications from its mixture with other diseases such as psorosis, gummosis, and cachexia. The effect of such mixtures of disease on infected trees can only be determined by further research.

Fortunately, much of the Florida citrus is now on rootstocks known to be tolerant to the tristeza virus. To date the rate of spread of the disease within groves on non-tolerant rootstocks is estimated as having been slow each year this rate may increase because of the larger number of infected trees serving as virus sources. This is particularly true of groves with a mixture of rootstocks where infected sweet orange tops on tolerant rootstocks remain apparently healthy but serve as sources of virus for an insect carrier.

A research program needs to be pushed as rapidly as possible to obtain information applicable to Florida conditions. Only on the results of such research can a sound program for the future be built.

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Citrus Rootstock Trials

A 9-Year Progress Report on Seven Rootstocks on Lakeland Fine Sand . . .

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USDA, ORLANDO, FLORIDA
AT MEETING FLORIDA STATE HORTICULTURAL SOCIETY

Numerous reports of scion-rootstock relations, ranging from cursory observation to complex and thorough studies, have been recorded in the literature (1). These reports are from all the citrus-growing areas of the world and, in general, are concerned with the particular problems of a given region. Of the older rootstock trials in this country, those initiated by Webber (1, p. 175) in California during the late twenties are the most extensive. In these plantings both sour orange and sweet orange have proved to be as good as any of those tested, and both are much better than Rough lemon stock because the last produces fruit of inferior quality.

Rough lemon, because of its vigor and high productivity, is at present the most popular rootstock for the sandy soils of the Ridge section of Florida. It is well recognized, however, that here, as in California and elsewhere, the quality of fruit grown on this rootstock is lower than that grown on sour orange, the other principal stock now used in this state. The phenomenal rise of the juice-concentrate industry during the past few years and the resulting demand for fruit of high solids content have stimulated interest in the possibilities of finding a rootstock which would be an improvement over Rough lemon. Several other rootstocks such as Cleopatra mandarin, sweet orange, and grapefruit, have been used in commercial plantings to a limited extent throughout the State. These plantings, however, do not provide adequate comparisons of rootstock performance because of differences in varieties, soils, cultivation practices, and ages of trees. Thus, only qualitative and often conflicting observations have been possible. The present paper is a progress report on a rootstock planting laid out in such a way and on a large enough scale so that the commonly used stocks can be compared rather precisely by statistical treatment of the data obtained.

Experimental Methods

In the spring of 1941 two scion varieties, Valencia and Parson Brown, were budded onto two-year-old seedlings of the following seven stocks: sour orange (**Citrus aurantium**) from two seed sources, Rough lemon (**C. limon**), Bowen grapefruit (**C. paradisi**), Cleopatra mandarin (**C. reticulata**), Parson Brown sweet orange (**C. sinensis**), and Rusk citrange (**Poncirus trifoliata x C. sinensis**). In the fall of 1942 the trees were set out with a planting distance of 20 x 30 feet on a recently cleared tract of virgin Lakeland fine sand located near Tavares in Lake County. Three trees on each stock were planted as a plot with 13 replications located in all parts of the experimental grove in order to minimize effects of such factors as soil variation and air drainage. The Parson Brown variety was planted adjacent to the Valencia and included unbudded Parson Brown seedlings of the same age as those which had been budded. A complete mixed fertilizer (N, P,K,Mg,Mn,Zn,Cu, and B) was applied to all plots three times each year through 1946, after which the mixture was changed to omit all phosphate. Soil pH was maintained at about 5.5 by applications of dolomitic limestone.

The measurements and records taken included trunk circumferences, fruit yields, and fruit samples for quality analyses. The latter were taken at various times during the ripening and harvest season. One fruit was taken at random from the four sides of each tree to make a 12-fruit sample per plot. The samples were weighed, the fruit sliced in halves, measurements of rind thickness made, and the juice extracted with an electric reamer. The percentage juice was determined by dividing the volume of juice by the total weight of the uncut fruit. A portion of the thoroughly-mixed juice was filtered through cheesecloth and the following determinations were made: Total soluble

Table 1. Tree growth and yields of oranges on various rootstocks

Rootstock	Cross-sectional area of trunks (Sq. Cm.) 1942	1947	1951	Percent trunk increase 1947-51 (weighted mean)	Yield (field boxes per tree) 1948	1951	(1947-51)
A. Parson Brown variety							
Sour orange No. 3	2.3	24.9	86.1	254	0.4	1.5	3.4
Sour orange A	2.3	29.5	95.1	229	0.6	1.8	4.5
Rough lemon	2.9	59.3	155.8	164	1.3	3.6	10.6
Bowen grapefruit	3.0	44.7	167.4	289	0.5	2.4	5.2
Cleopatra (Cleo)	2.6	48.2	157.7	234	0.6	2.6	6.3
Rusk citrange	2.8	48.0	94.7	98	1.1	2.3	7.5
P. B. budded (sweet)	3.2	48.4	138.3	189	0.8	2.4	6.1
P. B. seedling (sweet seedling)	4.6	89.9	301.9	238	0.6	2.5	4.3
L S D at 5%	0.4	7.0	17.6	36	0.2	0.4	1.0
L S D at 1%	0.5	9.4	23.3	48	0.3	0.6	1.4
B. Valencia variety							
Sour orange No. 3	2.9	26.3	103.4	333	0.4	1.0	2.6
Sour orange A	2.8	27.2	97.3	272	0.4	0.9	2.9
Rough lemon	2.9	65.9	190.6	192	1.2	2.5	9.3
Bowen grapefruit	2.7	40.6	166.6	336	0.5	1.3	3.8
Cleopatra (Cleo)	2.2	43.1	159.1	299	0.7	1.3	3.9
Rusk citrange	2.8	51.0	97.3	92	1.0	1.4	4.7
P. B. budded (sweet)	2.9	49.5	162.2	239	0.9	1.6	4.7
L S D at 5%	0.4	7.9	17.0	56	0.1	0.3	0.9
L S D at 1%	0.5	10.5	22.6	74	0.1	0.4	1.1

Abbreviations: L S D at 5% indicates the least difference necessary for significance between any two stocks at odds of 19:1; L S D at 1% level is the same, but with odds of 99:1. P. B. for Parson Brown.

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solids were determined by use of a Spencer, Abbe Type, Refractometer. Acidity was measured by titration with NaOH and was expressed as percentage of anhydrous citric acid. Vitamin C was determined by titration with 2,6-dichlorobenzenoneindophenol standardized against pure vitamin C (2). Fruit size records were obtained by counting the fruit in one one-half field box from each tree at harvest time.

Growth and Yield:

Experimental Results

The effects of the rootstocks on tree growth and fruit yields are summarized in table 1. Cross-sectional area of the tree trunk, calculated from trunk circumference measurements at 6-10 inches above the tree base, is used as a measure of tree size. The 1942 values are the sizes at the time the trees were set out in the field. It is interesting that even at that time, only 16 months after the trees were budded, the influence of the rootstocks had been such as to cause significant differences in tree sizes. As would be expected, the unbudded seedlings were by far the largest trees of the entire group at that time. Throughout the period of the experiment they have grown much faster than any of the budded trees, and therefore remarks concerning growth data in table 1 are restricted to the budded trees.

When budded to the Parson Brown variety, grapefruit and Parson Brown resulted in nursery trees which were significantly larger than those on Cleo and the two sour orange stocks (table 1, 1942 trunk area). Valencia scions on Cleo stock also produced trees significantly smaller than those on any of the other stocks, among which there were no measurable differences.

The 1947 trunk measurements of the Parson Brown variety show that five years after being set out the trees on Rough lemon were the largest of the group. There were no real differences among the four next largest—sweet, Cleo, Rusk, and grapefruit—but all were larger than the two sours.

Fruit yields for 1948, the first harvest year, do not parallel exactly the tree size. While yield for Rough lemon was the highest with 1.3 boxes per tree, Rusk citrange, not measurably different in size from three other stocks, was second with a yield of 1.1 boxes, greater at the 1% level than sweet, the third highest. The sweet seedling trees, by far the largest, were true to their reputation for shy bearing during early years by producing an average of only two fruit or .01 box per tree in this sixth year in the field!

Valencia tops on Rough lemon stock also resulted in the largest trees by 1947, while again the two sours were the most stunted of the group. In fruit yield the 1948 Valencia rankings were very similar to those for Parson Brown. That is, Rough lemon stock was highest, followed by Rusk, sweet, Cleo, and the sours.

The 1951 Parson Brown growth measurements, taken nine years after the grove was planted, showed the following relationships: Trees on grapefruit, Cleo, and Rough lemon were larger than the others. Those on sweet were intermediate, and Rusk and the two sours were the smallest. The most interesting change in growth ratings during the 1947-51 period was that of trees on the Rusk citrange; in 1947 they were among the largest trees, but in 1951 they were among the smallest. This slow-down in growth is indicated by the very low percentage trunk increase for this period. On the other hand, grapefruit stock resulted in the greatest growth increase.

The 1951 Parson Brown yields showed that Rough lemon with 3.6 boxes per tree, outproduced Cleo, next closest stock, by a full box per tree. No differences large enough to exceed natural variations were present among Cleo, unbudded sweet seedling, budded sweet, Rusk, and grapefruit; but all of this group outproduced the two sours. The total yields through the 1951 crop for these stocks are given in the last column of table 1. The high productivity of Rough lemon is outstanding. Its total yield is 41% greater than that of Rusk citrange, the next highest. Cleo and the budded sweet were about equal in yields, but the small difference between them is insignificant. The lack of production by the unbudded seedling during the early years is reflected in the low total yield for these trees. In total production sour A is significantly ahead of sour No. 3 by more than one box per tree more fruit.

The 1951 data for the Valencias, in both tree growth and yield, are very similar to those for the Parson Browns. Trees on Rough lemon were larger than those on any of the other stocks. Rusk showed the same decrease in rate of growth and grapefruit again resulted in the greatest increase in growth for the 1947-51 period. In further similarity Rough lemon produced almost one box per tree more fruit

Table 2. Effect of rootstocks on some physical qualities of fruit

Rootstock	Fruit size (No. frt. (field box)		Rind thickness (mm.)			Percent juice (% fresh weight)		
	1059	1951	1947	1950	1951	1947	1950	1951
A. Parson Brown variety*								
Sour orange No. 3	258	210	3.0	3.7	3.9	49.3	56.2	49.3
Sour orange A	246	212	3.0	3.6	3.8	51.2	56.2	48.6
Rough lemon	215	185	3.6	4.1	4.3	44.5	54.8	44.5
Bowen grapefruit	261	207	3.1	3.7	4.3	46.4	56.4	46.5
Cleopatra (Cleo)	251	216	3.0	3.7	4.0	47.6	55.8	47.8
Rusk citrange	241	183	3.1	4.1	4.2	49.6	55.7	49.0
P. B. budded (sweet)	247	199	3.0	3.8	4.1	47.6	54.8	47.3
P. B. seedling (unbudded sweet)	212	200	—	—	4.4	—	—	44.2
L S D at 5%	18	13	0.3	0.3	0.3	N.S.	N. S.	2.0
L S D at 1%	24	17	N. S.	0.4	0.4	N. S.	N. S.	2.7
B. Valencia variety**								
Sour orange No. 3	214	206	2.5	3.4	3.0	54.3	56.9	55.9
Sour orange A	210	209	2.7	3.5	3.0	51.5	57.9	56.6
Rough lemon	174	175	3.5	3.9	3.1	49.4	58.0	55.2
Bowen grapefruit	200	210	2.2	3.5	3.0	55.7	57.9	57.4
Cleopatra (Cleo)	197	220	2.3	3.5	2.9	54.5	57.7	56.1
Rusk citrange	208	191	2.7	3.3	2.9	54.4	52.8	57.5
Parson Brown	200	206	2.3	3.5	2.9	53.0	53.6	56.5
L S D at 5%	14	11	0.4	0.2	N. S.	3.0	1.7	1.2
L S D at 1%	19	15	0.6	0.3	N. S.	4.3	2.3	N. S.

Abbrevations: N. S. indicates that differences are not significant at the given levels; L S D at 5% indicates the least difference necessary for significance between any two stocks at odds of 19:1; L S D at 1% level is the same, but with odds of 99:1.

*Parson Brown samples taken Nov. 6, 1947; Nov. 6, 1950; Feb. 21, 1952.

**Valencia samples taken Mar. 12, 1948; May 21, 1951; April 11, 1952.

than the next highest stock, and the two sours were again the lowest producers. In total yield of Valencia fruit the Rough lemon stood out even more strikingly than it did with the Parson Brown. The yield of 9.3 boxes was almost double than from Rusk or sweet, the two stocks tied for second place. The two sours were lowest; in this case, however, there was no difference between them.

External fruit quality:

Table 2 lists the measurements of the physical qualities—fruit size, rind thickness, and percentage juice—of both varieties grown on the different stocks. Very small crops of fruit were produced on these trees in 1947 and the limited data obtained for that year are listed for comparison with tose taken in later years. A study of the data in table 2 makes evident two facts: (1) that fruit from Rough lemon stock is in a class by itself and (2) that there are no clear-cut, consistent differences among the others. With Rough lemon omitted, differences were usually so small as to be insignificant or else they were so inconsistent from one year to the next that definite quality ratings were difficult to make. No stock ranked well on all three of these physical criteria. With both varieties Rough lemon produced the largest fruit with the thickest peel and the lowest percentage of juice. Parson Brown fruit on the sour orange stocks was thin-skinned and high in juice content, but these desirable qualities were associated with small size. Rusk citrange produced Parson Brown fruit of fair size with a little better than average juice content but with a trend toward thick peel. With Valencia as the scion variety, grapefruit stock produced thin-skinned, high-juice fruit of average size, ranking as high as that from the sour orange stocks, but again except for Rough lemon there was little difference among stocks.

Internal fruit quality:

A more critical evaluation of fruit quality is based on the chemical analysis of the juice for vitamin C, citric acid, and percent total soluble solids. These data are summarized in table 3. Here the sampling date in relation to the degree of fruit maturity should be taken into consideration. It will be noted that the 1947 and 1950 Parson Brown samples were taken early in November just before full maturity had been reached, while the 1951 samples were taken at the very end of the harvest. These data for the Parson Brown variety in table 3 show the relatively poor quality of fruit on Rough lemon and grapefruit stocks. Rough lemon fruit was lowest in vitamin C, citric acid, and in percent solids. Its low acid content resulted in a high solids/acid ratio, but the solids were too low at the time of sampling in 1947 to pass the minimum value of 8.7% then required. Solids in the fruit from grapefruit ran a little higher than those from Rough lemon, but the low solids in 1947 and the high acids in 1950 kept this fruit from meeting the legal maturity requirement at sampling time. Consistently the highest solids were found in the fruit from the two sours and from Rusk citrange, with these values being much greater than those from Rough lemon and grapefruit. Cleo, sweet, and unbudded Parson Brown seedlings were an intermediate group with no real differences among them in regard to these internal factors.

In the Valencia data it will be noted that the 1947 samples were picked early in the Valencia harvest season, while the 1950 and 1951 samples were picked much

Table 3. Some effects of rootstocks on the juice composition of oranges

Rootstock	Vitamin C (mgm. per 100 ml.)			Citric acid (wt. % of juice)			Total soluble solids (wt. % of juice)			Solids/Acids ratio		
	1947	1950	1951	1947	1950	1951	1947	1950	1951	1947	1950	1951
A. Parson Brown variety*												
Sour orange No. 3	—	56.1	59.7	0.83	0.97	0.59	9.68	10.22	13.06	11.7	10.8	22.3
Sour orange A	—	56.7	57.2	0.82	0.96	0.57	9.80	10.41	13.14	12.1	11.2	23.1
Rough lemon	—	51.1	52.6	0.60	0.80	0.55	8.07	9.04	11.53	13.6	11.4	21.2
Bowen grapefruit	—	53.9	56.0	0.88	1.05	0.61	8.61	9.32	12.29	9.8	8.9	21.4
Cleopatra (Cleo)	—	53.6	54.0	0.73	0.89	0.54	8.83	9.74	12.53	12.2	11.1	23.3
Rusk citrange	—	50.6	52.8	0.71	0.81	0.55	9.37	9.98	13.06	13.2	12.4	23.6
Parson Brown (sweet)	—	53.4	54.5	0.80	0.95	0.56	9.01	9.62	12.74	11.3	10.2	22.9
Parson Brown seedling	—	—	55.0	—	—	0.55	—	—	12.50	—	—	22.8
L S D at 5%		2.4	3.0	0.10	0.10	0.04	0.29	0.29	0.43	1.6	1.4	N. S.
L S D at 1%		3.3	4.1	0.14	0.14	N. S.	0.41	0.39	0.57	2.3	1.8	N. S.
B. Valencia variety**												
Sour orange No. 3	59	61.0	51.6	1.12	1.03	0.93	12.22	14.00	12.90	11.0	13.7	13.9
Sour orange A	59	62.2	52.9	1.16	1.12	0.99	12.36	14.42	13.28	10.6	13.0	13.4
Rough lemon	49	54.3	49.3	0.91	1.01	0.91	10.38	12.22	11.97	11.4	12.1	13.3
Bowen grapefruit	51	60.2	51.1	1.09	1.15	0.96	11.30	13.71	12.79	10.5	12.0	13.3
Cleopatra (Cleo)	49	57.6	51.2	0.99	1.08	0.97	11.52	13.37	13.01	11.6	12.4	13.4
Rusk citrange	52	57.9	48.8	1.06	1.18	0.98	12.00	14.64	13.07	11.3	12.4	13.3
Parson Brown (sweet)	51	59.4	50.1	1.01	1.18	0.99	11.74	14.09	12.76	11.6	12.0	12.9
L S D at 5%	5	2.3	N. S.	0.14	0.01	N. S.	0.47	0.26	0.61	N. S.	0.6	N. S.
L S D at 1%	7	3.1	N. S.	N. S.	0.08	N. S.	0.66	0.34	0.82	N. S.	0.8	N. S.

Abbreviations: N. S. indicates that differences are not significant at the given levels; L S D at 5% indicates the least difference necessary for significance between any two stocks at odds of 19:1; L S D at 1% level is the same, but with odds of 99:1.

*Parson Brown samples taken Nov. 6, 1947; Nov. 1950; Feb. 21, 1952.

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later. The results from the Valencia juice analyses are similar to those from the Parson Brown samples. Rough lemon here also produced fruit which was lowest in all three components. Grapefruit, however, produced much better fruit when used for Valencia than when used for Parson Brown so that, instead of being classed with Rough lemon, it fell into the intermediate group along with Cleo and sweet. Rusk and the sours resulted in consistently high soluble solids in the Valencia fruit as they did in the Parson Brown.

Discussion and Conclusions

It has been rather commonly acepted that, of the stocks in general use at present, Rough lemon produces the most vigorous tree, especially in the sandy soils of the Ridge area. The data presented here, however, while in agreement with this generalization, indicate that the period of greatest difference in growth rates may occur while the trees are rather young. The 1947 data show that trees of both varieties on Rough lemon stock were significantly larger than those on any of the other stocks, but by 1951, four years later and nine years after the trees were set out, the differences were not so outstanding. Parson Brown trees on both Cleo and grapefruit were as large as those on Rough lemon. Valencia trees on Rough lemon were still larger than any of the others, but growth rates in terms of percent trunk increase for the 1947-51 period show for both varieties that Rough lemon has slowed down in relation to most of the other stocks. At the present time only the sours and Rusk citrange continue to be appreciably dwarfed (Figs. 1 and 2). Of the last group the trunk increase data would suggest that the sours might continue to grow at a rate which would maintain the present differences relative to the other stocks. The point of greatest interest is the very much decreased growth rate of trees of both varieties on Rusk. At present one may only guess as to an explanation for this behavior. It might be the genetic nature of Rusk to lose its vigor and slow down at an early age when budded to these scion varieties; it could be the expression of a greater susceptibility to some otherwise masked virus; and there is also the possibility that Rusk might have a greater requirement than any of the other stocks for some particular nutrient element. Further experimental evidence will be necessary if this question is to be answered satisfactorily.

In respect to yield of fruit Rough lemon has so far proved to be far ahead of the other stocks tested. This is true whether one considers the first crop, the latest one, or the total production to the present time. For example, on total yield of Parson Browns, the second place Rusk has yielded only 71% as much fruit as has the Rough lemon. With Valencia tops Rough lemon is even farther ahead of the group; Rusk and budded sweet tied for second place, having produced only 51% as much fruit during the four harvest years as did the Rough lemon.

The advantage of high yields of both Parson Brown and Valencia on Rough lemon stock must be weighed against the corresponding reduction in fruit quality on this stock. As shown by the data in tables 2 and 3, fruit produced on Rough lemon was, in every respect except size, inferior to that grown on other stocks. If the fruit is destined for the fresh fruit market, the larger size might be an advantage, but the slightly lower juice content, the thick peel, and the qualitative observations that such fruit has both a coarse-textured peel and flesh all combine to lower the fresh market demands for such fruit.

The greatest concern is felt, however, where the crop is to be processed as concentrate. Here, to, it is desirable to have fruit of high vitamin C and citric acid content. High solids content, however, is not only desirable, but also of great economic importance. Wenzel et al (3), in a discussion of some of the factors and costs involved in the concentrate industry, point out that the percent of soluble solids in the juice is involved in determining both the amount of concentrate which may be obtained from a box of fruit and also the actual cost of processing the juice. A major part of the operating costs of the plant is in the removal of water from the juice, that is, in the actual concentrating operation. Therefore, not only is the manufacturing cost higher per gallon of concentrate from low-solids juice, but the capacity production of the plant is also lowered. For example, a plant

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with a given evaporating capacity can produce 28% more concentrate per hour from 12% solids juice than from juice with only 10% solids. Thus, it can easily be seen why the processor would prefer to obtain those solids in the more concentrated state associated with high quality fruit whenever such fruit is available.

General observation by people in the citrus industry and the specific data presented here indicate that Rough lemon stock will not result in fruit quality as high as that obtainable on most other stocks. In the present trials sour orange and Rusk citrange produced fruit with high solids. The other stocks were intermediate between these and Rough lemon except that Parson Brown fruit grown on grapefruit was almost as poor in quality as that from Rough lemon. Both scion varieties, when grown on Rough lemon stock, produced low-quality juice, but the greater box yields from Rough lemon stock more than compensated for this dilution effect. Thus, even in terms of pounds of total solids per acre, Rough lemon still held first place.

This experiment and the data presented here are a good example of one of the major difficulties in testing rootstocks; that is, the length of time required to obtain conclusive results. It would seem that Rough lemon is beyond all question the best of these stocks, yet it must be remembered that the economically-important production period of these trees has hardly been reached. The payoff lies in the production over a long period by mature trees. The Parson Brown unbudded seedlings did not begin to bear at all until 1949, their seventh year in the field, but in 1951 the crop of good quality fruit was equal to that from trees on any stock except Rough lemon. Will their production now increase at a rate which will cause them to overtake and perhaps exceed that of trees on Rough lemon; and if so, how long will this require?

There is a rather widespread belief in the industry that Valencia trees on Cleo stock tend toward light bearing in the early years, but that production by mature trees is more satisfactory. The first part of this contention is supported by the data given here, but the latter part remains to be proved. Thus, careful performance records will have to be obtained for several more seasons before definite conclusions can safely be drawn regarding this stock.

Another important factor to be considered in evaluating rootstocks is the effect of the stock on the cold hardiness of the top. These trees have yet to be subjected to temperatures low enough to result in measurable damage, and until such a freeze occurs it will not be possible to rate the stocks in this regard.

Although so much time is required for these trials, there is every reason to believe that rootstocks which will be an economic improvement over those in use today can be found. Rusk citrange was the only "stranger" among these familiar stocks, yet fruit production from trees on it, to the present time at least, is next to that of those on Rough lemon. Improvement no doubt can be made also in the performance of the currently used rootstocks by the selection of superior strains. In the data reported here two sources of sour orange seed are identified by "Sour A" and "Sour No. 3" and although differences are significant only in the total yield for the Parson Brown variety, the former shows an overall slight superiority over the Sour No. 3.

These rootstock trials on a typical soil in the Ridge section have confirmed the characteristics of Rough lemon stock in regard to tree vigor, precocity, high yields, and poor fruit quality. Sour orange stock has resulted in stunted trees with low yields of high quality fruit. The other stocks are intermediate in both yields and quality except that Rusk citrange, with fruit quality equal to that from the sours, has produced much higher yields than the latter.

Other than these broad considerations, no conclusions may be reached at the present time.

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RANDALL CUBBEGE, Scientific Aid;
H. W. HRUSCHKA, Asso. Physiologist;
G. A. MECKSTROTH, Asso. Pathologist

(Continued From Last Issue)

Cars E and F afforded a comparison of crated oranges in pre-iced cars equipped with Preco fans kept "on" during the transit period. The load in car E was not precooled but was re-iced at Hamlet. Car F was precooled with the car fans for six hours at the shipping point, and was re-iced at Wildwood. When the cars left Wildwood the non-precooled load was 7.3 degrees warmer than the precooled load. It required 12 to 18 hours for the non-precooled load, car E re-iced at Hamlet, to become as cool as the precooled load was at Wildwood. Thereafter, the non-precooled load with its refilled ice bunkers cooled faster. On arrival at Potomac Yards, there was no significant difference in commodity temperatures between the two cars, and on arrival at Greenville Yards, the non-precooled load was about 1 degree cooler than the precooled load.

Cars A and G. These two cars received the same icing and ventilation service, and differed only in loading, car A being the double deck car with bagged load and car G having bags over crates. The difference in average commodity temperatures during the transit period was not great enough to be of practical significance and was no greater than is often encountered between similar loads, in cars of similar design.

RIND BREAKDOWN AND DECAY

For the purpose of aiding in the evaluation of the effect upon rind breakdown and decay of the two types of packages and the several refrigeration-in-transit procedures followed, a test package of strictly comparable Pineapple oranges, U. S. No. 1 Grade, size 200, was placed in the top quarterlength of each car for critical inspection at destination. Because of the difference in lapsed time between loading and first inspection which ranged from four to eleven days, no clear cut deductions can be drawn from the test lots, regarding the effect of temperature in transit on the rind breakdown and decay.

Although the Pineapple variety of orange is susceptible to pitting, a form of rind breakdown, yet it was not visible at the time of packing, nor was it expected to develop in such unusual proportions.

At the first inspection at destination, rind breakdown had developed in from 4.5 percent to 50 percent of the test fruit in the cars inspected within four or five days after loading and from 37.8 percent to 93.4 percent in the test packages in the cars inspected eleven days after loading. A week after the first inspection, rind breakdown had increased greatly in all lots ranging from 51 percent to 88 percent in the former grouping and from 77 percent to 91 percent in the latter. The least amount of rind breakdown at the

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first inspection was found in the car that had been precooled. There was no decay in any of the test packages at unloading. One week later, total decay ranged from 2 percent to 5.6 percent in the lots from the cars unloaded within a day after arrival at New York whereas from 4.5 percent to 9.6 percent decay was found in the test lots from cars held several days before unloading. In the precooled car, practically all of the decay was stem-end rot; in the others, decay was rather equally divided between green mold and stem-end rot.

The Railroad Perishable Inspection Agency made their usual general inspection of the several cars on arrival at destination three and four days after loading. In general their finding in regard to decay were in harmony with those observed in the test packages removed from the cars and inspected from four to eleven days after loading. The significant difference between the two inspection reports was in the amount of rind breakdown observed. This condition, like decay, varies from grove to grove and increases with the lapse of time. The test packages were from a source different from those supplying the carlots of fruit and for that reason such differenecs are not uncommon.

DISCUSSION

The abnormally cold weather encountered by these test cars afforded an unanticipated opportunity to determine the rate of cooling in different parts of the car when vents were open and hatch plugs were out in sub-freezing weather, a situation not often encountered during the first 36-40 hours in the transit period. Accordingly, the vents of one car were opened at Savannah and those of several other cars were opened at Hamlet the following morning while the vents in the remainder were kept closed to destination, as though the outside air temperatures were nearly normal.

This transportation test shows that, even with all vents full open, when outside temperatures were well below freezing during the first day or two in transit, there is not much danger of freezing citrus fruit loaded warm and shipped under existing provisions of the Perishable Protection Tariff. Whereas temperatures in car D dropped to the freezing point in parts of the car, it should be noted that all vents were full open when outside air temperatures were as low as 15°F. If diagonal vents only had been open the temperature would not have dropped so close to the danger point. It therefore seems that cars may move from Florida points billed "plugs out, vents open" (P.O.V.O.) to Richmond or Potomac Yards, standard ventilation beyond (Rule 385—combination ventilation—keep vents open to Richmond/Potomac Yards, standard ventilation thereafter). During those rather rare periods when the entire south is experiencing freezing weather such as encountered in this test, and when a car is passing through temperatures well below freezing through North and South Carolina, vents may be kept open until the temperature is down to 25° with standard ventilation beyond those points. (Rule 385, combination ventilation. Vents closed at 25°, open above 25° to ..... (specify station south of northern boundary of North Carolina or Tennessee or east of Mississippi River) standard

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A more realistic schedule for opening and closing vents of cars loaded with Florida oranges, grapefruit and tangerines and billed for ventilation en route would result in better refrigeration in cold to sub-freezing weather than is now the case under standard ventilation, or even under standard refrigeration, which is little if any more effective than is Rule 251 in lowering commodity temperatures during the colder months. Whenever the outside air temperature is considerably below that of the commodity in the car, more rapid cooling may be expected when the vents are open, with or without ice in the bunkers.

In all probability much greater financial losses have resulted from decay developing in cars of Florida fruit when the vents were closed before the fruit had cooled to a safe temperature, than has resulted in freezing damage from leaving the vents open too long.

Continuous ventilation from Savannah to Potomac Yards, when the outside air temperature was well below freezing much of the time, caused the load in a non-fan car to cool much more rapidly than that in re-iced fan cars with vents kept closed.

The precooling of citrus after loading in pre-iced fan cars may not be a necessary step particularly if the car moves within a few hours after loading is completed. The time lag in getting warm fruit to a safe temperature when loaded in a fan car does not appear to be great enough to have much effect on decay in Florida citrus. However, in periods of heavy decay it would be prudent to run the fans until the pickup train comes along.

The decrease in the hourly rate of cooling doubtless resulted largely from the progressively decreased supply of ice in the bunkers. Yet, when the commodity temperature is below 60°, the hourly rate of cooling is slow without the aid of salt, even with bunkers full of ice. If the load is precooled for several hours, the bunkers should be replenished at loading station or the following morning of the car is to receive one re-icing in transit.

The fan car, by cooling the top of the load much more rapidly, always gives a more uniform tem-

(Continued on Inside Back Cover)

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The LYONIZER

Department

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Reports Of Our Field Men . . .

PASCO AND E. HILLSBOROUGH COUNTIES

E. A. McCartney

As everyone knows we have had some very cold weather the past two weeks throughout the state. This section has been hurt but the extent of the damage at this date Dec. 16 is not known. Vegetables were probably damaged the most.

Citrus has come through in good shape as I have not found any fruit damage. Young trees in some spots have been hurt but not to any great extent.

Fruit prices are encouraging having increased 25 cents a box in the last two weeks.

The rains over the week end helped the citrus considerably and the preparation for melon planting.

The December application of fertilizer is about over on citrus and there is a more optimistic feeling among the growers as it looks as if the prices will continue to get better.

NORTH CENTRAL FLORIDA

V. E. Bourland

We had a very nice shower recently which has helped everything, as it was getting very dry. Fruit has been, and is being picked steadily, but prices haven't been too satisfactory for the growers. There is a feeling now that fruit will bring the grower more money as time goes on.

The pastures are all burned over by the frost and cold, and the majority of the cattle have begun to show the lack of the green grass.

Wishing all the growers a Merry Christmas and a Prosperous New Year.

SOUTHWEST FLORIDA

Eaves Allison

Citrus quality has been improving with the advance of the season and the cold spell at this time, Dec. 15th, is expected to hasten the maturity and coloring of early and mid-season fruit and all varieties of grapefruit. Fairly good rains preceding the cold weather have given the moisture content of the soil a needed boost.

Tomato harvesting has been slow on account of the early season disasterous rains, and the cold weather at this time has further slowed up the vine growth as well as the ripening of the fruit. However quality should be definitely benefited and slower shipments should reflect a better price in the market.

NORTH HILLSBOROUGH AND PINELLAS COUNTIES

J. A. Hoffman

Many growers have completed their fall application of fertilizer and cultivation. Red spider and rust mite have been very active and growers have been spraying with Sulphur and DN. Growers with wood and other firing facilities have been busy distributing the wood and oil heaters throughout their groves. There has been no damage to citrus by cold weather at this time, Dec. 18. A few vegetable crops have been frost bitten. Fruit prices are about the same. Some growers are expecting the prices to go up after the holiday season.

Light rains have helped both citrus and watermelon growers.

WEST CENTRAL FLORIDA

J. E. Mickler

This month marks the beginning of the holiday season and most groves in this section are being cleaned of fruit. The Fall applications have been wound up and the majority of groves look very good. Insect activities have not been abnormal so far. Little moisture is left and rain would be a very nice Christmas present for all concerned.

The pastures that were fertilized in the Fall are now paying off in high nutritive grass even though frost bitten. With the high cost of feed and the lower prices of cattle this condition is proving to be of help in to the cattlemen.

May I join in and wish everyone a very Merry Christmas.

SOUTH POLK, HIGHLANDS, DESOTO AND HARDEE COUNTIES

C. R. Wingfield

After some very low temperatures and several white frosts during the middle of December, it appears there will be very little damage to citrus. There will possibly be some frost bitten leaves on tender growth of young sets located in low ground areas. No fruit damage has been reported. The cold weather will have a tendency to improve the eating quality of the fruit.

There has been heavy citrus fruit movements during the month both to canners and the fresh fruit markets which has brought some strength to the buyers' market. This has caused better offers for mid-season fruit as well as to early fruit that is unsold.

Some groves are still without a Fall application which is of great importance in supplying proper amount of plant foods to bring a healthy bloom. We should remember the feeder root system will not be active when ground is cold and needs more time to assimilate the necessary plant foods.

Rust mite and Red Spider are active and should be watched constantly. A control for these should be applied before the damage is seen.

POLK AND HIGHLANDS COUNTIES

J. T. Griffiths and J. K. Enzor, Jr.

By the end of December all Lyons growers in this area will have applied a Fall application of fertilizer. Groves are in generally good condition. There is considerably less "greasy spot" than a year ago and leaf drop has not been severe. However, a normal leaf drop has occurred in many groves in December. This has been sufficiently observed to concern some growers.

Purple mites have increased but as this is written in mid-December very little injury as evidence, mesophyll collapse, has occurred.

A year ago yellow veined leaves were noted in many young groves during the winter months. This condition is beginning to develop again. It is particularly prevalent on red and pink grapefruit, but has been observed on almost all varieties. The cause is not completely understood, although it has been suggested by Smith of the USDA that it is a symptom of Boron deficiency. In tangerines the condition has been found to be associated with collar rot.

XUM

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Uncle Bill Says:

They's a lot of things we'd like to say at this season of the year . . . but we just ain't got the right words to tell 'em.

But one thing is for sure, if every grower in Florida has just half the success during the year 1953 that we're hopin' they'll have then all of 'em will be in mighty good shape by the time 1954 rolls around.

We're mighty proud of the association we've had with so many of you durin' the years past . . . and we've tried our level best to merit the confidence you've shown in us, and we're goin' to keep right on tryin' to serve you better and better with each passin' year.

They ain't much more we can say 'ceptin' to repeat that we wish you Prosperity, Happiness and Good Health in the year that has just started.

Citrus Exposition At W. Haven, Feb. 16-21

The 1953 Florida Citrus Exposition to be held in Winter Haven Feb. 16-21 will award premiums worth several thousand dollars for displays of all varieties of citrus fruits in commercial packages, John A. Lang, president of the citrus show said recently.

The fresh fruit competition, open to all growers and shippers in the state, will have prizes for the best packs in each citrus commission district, with winners in the area classifications being automaticly entered in the "best in variety" group. The premium winners in this latter grouping will then be judged for 'best in show" with a sweepstakes or "grand champion" award.

CITRUS INSECT CONTROL FOR JANUARY, 1953

(Continued from Page 4)

1953 "Better Fruit Program." All necessary materials for the dormant applications and the dilutions of the materials are listed under Formula 1 in the Spray Schedule. For information not included in the Spray Schedule consult the Citrus Experiment Station at Lake Alfred or the Indian River Field Laboratory at Fort Pierce.

Classified Ads

FOR SALE — THE BEST QUALITY CITRUS TREES. Several thousand Temple, Citra Pineapple, Pink Seedless and Red Grapefruit trees on Sour Orange root. Contact Frank K. Chase, Telephone 84-501, Auburndale, Florida.

SUPERIOR CITRUS TREES—Now available on Rough Lemon, Sour Orange, Sweet Orange, and Cleo Rootstocks. Prices $1.10 up, depending on the size and number ordered. Also Seedlings for lining out of all varieties. Write for 'Tips to Growers".
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CITRUS TREES, in quantity. Valencia, Pineapple, Pink Seedless Grapefruit ,on rough lemon root, for Summer and Fall delivery, ⅝" to ¾". Also trees budded to order.
ORANGE STATE NURSERIES
Zellwood, Florida

EVIDENCE OF TRISTEZA, OR QUICK DECLINE, VIRUS IN FLORIDA

(Continued from page 7)

Summary Edition:

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FT. PIERCE, FLA.

RAIL REFRIGERATION TEST ON FLORIDA CITRUS — NOV. 1950

(Continued from page 15)

perature throughout the load than does the non-fan car receiving the same protective service, even even though the average of the top, middle, and bottom of the load is likely to be nearly the same.

It is especially noteworthy that all cars including those iced but once had enough ice in the bunkers on arrival at destination to hold the load at a safe temperature for several days of seasonable weather. The ice bunkers of car D, vented at Savannah, were at least half full on arrival at destination, and this car also had the lowest commodity temperature.

SUMMARY

Oranges in open mesh bags loaded in double deck cars or loaded over two layers of crated fruit cooled about as rapidly during the transsit period as did solid loads of crated oranges.

Oranges loaded in fan equipped double deck cars cool more uniformly than those in non-fan cars.

In a carload of 525 crates of oranges with fruit temperature of 81.5°, loaded in a pre-iced fan car and precooled six hours with motor driven by Preco fans, the fruit cooled 4.9 degrees during the four hour loading period, and 13.4 degrees during the six hour precooling period. More than half of the total of 18.3 degrees was removed by the end of the first hour of precooling.

Ventilation during this transit period of sub-normal air temperature in the South cooled the load more rapidly than did refilling the ice bunkers and keeping the vents closed to destination, thus indicating that during the cooler months, initial icing followed by ventilation north of Savannah is likely to result in more rapid cooling than by re-icing once and keeping the vents closed to destination.

During periods of nearly normal winter temperatures at destination, the commodity temperatures did not rise in cars that arrived with less than one ton of ice in the bunkers and which were held several days before unloading. These tests indicate that all or only diagonal vents of cars loaded with warm fruit may be left open for considerable periods of time at least during the first day or two after loading—even when outside air temperatures are well below 25°—without danger of freezing the fruit.

ACKNOWLEDGEMENTS

These tests were made possible by the generous cooperation of the carrying, shipping and receiving agencies and their several representatives. Acknowledgement is due Fruit Growers Express Co., Seaboard Air Line, Richmond, Fredericksburg and Potomac, and Pennsylvania Railways; also the Atlantic Commission Company, the East-West Produce Company, Florida Citrus Exchange, Growers and Shippers League of Florida, Plymouth Citrus Growers Association, Lake Region C. G. A., Winter Garden C. G. A., Zellwood Fruit Co., and the Growers Marketing Service, for their assistance.

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To produce good quality and yield, citrus trees must have an adequate supply of magnesium. Here's why:
Plants grow by the chemical actions of mineral nutrients, sunlight, water and carbon dioxide. The key to the combination is *chlorophyll*, the green plant substance that is essential for all plant life. Chlorophyll draws from the sun the energy needed for plant growth. Formation of chlorophyll in the plant depends on *magnesium*. If insufficient magnesium is available to the citrus tree, a typical deficiency symptom is a loss of the normal green color in the leaves. Magnesium-deficient citrus trees shed leaves in late summer or fall, leaving the fruit unprotected. The defoliated twigs become weak, subject to fungus infection and usually die. Magnesium deficiency symptoms are a warning signal that the chlorophyll content of the citrus tree is too low to capture enough of the sun's energy for healthy crop growth.

Experience shows that the most effective and economical way to supply the magnesium needed by citrus trees is in soluble form in mixed fertilizers. *Sul-Po-Mag* is a properly balanced combination of magnesium and potash, both in *sulfate form*, water soluble and immediately available to the crop. Leading manufacturers are now including *Sul-Po-Mag* in their mixed fertilizers for the profitable production of citrus.

Six Basic Functions of Magnesium

- Magnesium is the basic metallic element in chlorophyll, the green plant substance which captures the sun's energy that is vital for life and growth.
- Magnesium concentrates in the seed with phosphorus to aid in the formation of oils and proteins required for viable seed.
- Magnesium functions as a carrier of phosphates to the actively growing and fruiting parts of the plant.
- Magnesium is required to activate the processes which stimulate the production and transport of carbohydrates and proteins within the growing plant.
- Magnesium, in sufficient quantities, enables the plant to utilize other plant nutrients for healthy, disease-resistant growth.
- Magnesium stimulates the growth of soil bacteria and increases the nitrogen-fixing power of legumes.

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may be mixed with nitrogen, potash, and magnesium. Where deficiency is severe include sufficient Ferro-grene for one half pound per tree. See table below.

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Amounts of Ferro-grene per ton for severe deficiency

Lbs. of fertilizer per tree	No. trees to be fertilized with one ton	Lbs. of Ferro-grene per ton
10	200	100
15	133	67
20	100	50
25	80	40
30	67	34

Reduce the amounts where only mild deficiencies exist

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